Claims

In the claims:

1. (Original) A communication bus suitable for use in a hazardous area of a process plant, the communication bus comprising:

a first transmission path adapted to communicate electrical signals in a first direction;

a second transmission path adapted to communicate electrical signals in a second direction; and

a safety device coupled to each of the first and second transmission paths, wherein the safety device includes a control unit adapted to detect a fault condition associated with the communication bus, and wherein the safety device further includes a switch unit adapted to interrupt the flow of electrical signals along each of the first and second transmission paths in response to the detected fault condition.

2. (Original) The communication bus of claim 1, wherein the detected fault condition associated with the communication bus includes at least one of an open circuit, an electrical discontinuity, a cut in the communication bus, a severed communication bus, and a disconnected end of the communication bus.

3. (Original) The communication bus of claim 1, further including a third transmission path and a fourth transmission path, wherein the safety device is coupled to each of the third and fourth transmission paths.

4. (Original) The communication bus of claim 3, wherein each of the first, second, third, and fourth transmission paths includes twisted pair cable or coaxial cable.

5. (Original) The communication bus of claim 3, wherein the control unit includes a first control device coupled to the third transmission path and a second control device coupled to the fourth transmission path, wherein the first control device includes a first signal source adapted to generate an electrical signal that is communicated in the first direction along the third transmission path, and wherein the second control device includes a second signal source adapted to generate an

electrical signal that is communicated in the second direction along the fourth transmission path.

6. (Original) The communication bus of claim 5, wherein the first control device includes a first sensor adapted to measure an electrical characteristic associated with the third transmission path, and wherein the second control device includes a second sensor adapted to measure an electrical characteristic associated with the fourth transmission path.

7. (Original) The communication bus of claim 6, wherein the measured electrical characteristic associated with each of the third and fourth transmission paths includes current, voltage, or resistance.

8. (Original) The communication bus of claim 6, wherein the first control device includes a first comparator adapted to compare the measured electrical characteristic associated with the third transmission path to a normal operational value, and wherein the second control device includes a second comparator adapted to compare the measured electrical characteristic associated with the fourth transmission path to the normal operational value.

9. (Original) The communication bus of claim 8, wherein the switch unit includes a first switch coupled to the first control device and a second switch coupled to the second control device.

10. (Original) The communication bus of claim 9, wherein at least one of the first switch, the second switch, the first control device, and the second control device is housed in a protective enclosure.

11. (Original) The communication bus of claim 9, wherein the first switch includes a first relay and a second relay, and the second switch includes a third relay and a fourth relay, wherein each of the first and second relays is coupled to the first control device, and wherein each of the third and fourth relays is coupled to the second control device.

12. (Original) The communication bus of claim 11, wherein the first control device is adapted to energize and de-energize coils associated with each of the

first and second relays, and wherein the second control device is adapted to energize and de-energize coils associated with each of the third and fourth relays.

13. (Original) The communication bus of claim 11, wherein each of the first and third relays is coupled to the first transmission path, and wherein each of the second and fourth relays is coupled to the second transmission path.

14. (Original) The communication bus of claim 13, wherein each of the first, second, third, and fourth relays includes contacts that are closed during normal operation.

15. (Original) The communication bus of claim 14, wherein the first control device is adapted to open the contacts of the first and second relays in response to a change in the measured electrical characteristic associated with the third transmission path from the normal operational value, and wherein the second control device is adapted to open the contacts of the third and fourth relays in response to a change in the measured electrical characteristic associated with the fourth transmission path from the normal operational value.

16. (Original) A safety device adapted for use in a hazardous area of a process plant, the safety device comprising:

a communication bus including a first transmission line and a second transmission line, wherein both the first and second transmission lines are adapted to communicate electrical signals;

a control unit coupled to the second transmission line adapted to detect a fault condition associated with the communication bus; and

a switch unit coupled to the first transmission line and the control unit, wherein the switch unit is adapted to interrupt the flow of electrical signals along the first transmission line in response to the detected fault condition associated with the communication bus.

17. (Original) The safety device of claim 16, wherein the control unit includes a sensor adapted to measure an electrical characteristic associated with the second transmission line.

18. (Original) The safety device of claim 17, wherein the measured electrical characteristic associated with the second transmission line includes current, voltage, or resistance.

19. (Original) The safety device of claim 17, wherein the control unit includes a comparator adapted to compare the measured electrical characteristic associated with the second transmission line to a normal operational value.

20. (Original) The safety device of claim 19, wherein the first transmission line includes a first transmission signal path adapted to communicate electrical signals in a first direction, and a second transmission signal path adapted to communicate electrical signals in a second direction.

21. (Original) The safety device of claim 20, wherein the second transmission line includes a third transmission signal path adapted to communicate electrical signals in the first direction, and a fourth transmission signal path adapted to communicate electrical signals in the second direction.

22. (Original) The safety device of claim 21, wherein each of the first, second, third, and fourth transmission signal paths includes one wire or two wires.

23. (Original) The safety device of claim 21, wherein the control unit includes a first control device coupled to the third transmission signal path and a second control device coupled to the fourth transmission signal path.

24. (Original) The safety device of claim 23, wherein the switch unit includes a first switch, a second switch, a third switch, and a fourth switch, wherein each of the first and third switches is coupled to the first transmission signal path, and wherein each of the second and fourth switches is coupled to the second transmission signal path.

25. (Original) The safety device of claim 24, wherein the first control device is coupled to each of the first and second switches, and wherein the second control device is coupled to each of the third and fourth switches.

26. (Original) The safety device of claim 25, wherein each of the first, second, third, and fourth switches includes contacts that are closed during normal operation.

27. (Original) The safety device of claim 26, wherein the first control device is adapted to open the contacts of the first and second switches in response to a change in the measured electrical characteristic associated with the third transmission signal path from the normal operational value, and wherein the second control device is adapted to open the contacts of the third and fourth switches in response to a change in the measured electrical characteristic associated with the fourth transmission signal path from the normal operational value.

28. (Original) The safety device of claim 16, wherein each of the first and second transmission lines includes a twisted pair cable or a coaxial cable.

29. (Original) The safety device of claim 16, wherein the first transmission line is adapted to communicate electrical signals using a communication protocol based on Ethernet, Fieldbus, HART, PROFIBUS, WORLDFIP, Device-Net, As-Interface, or CAN.

30. (Original) The safety device of claim 16, wherein the control unit includes a signal source adapted to generate an electrical signal that is communicated along the second transmission line.

31. (Original) A method for providing a communication bus suitable for use in a hazardous area of a process plant, the method comprising:

communicating electrical signals along a first transmission path;

communicating electrical signals along a second transmission path;

measuring an electrical characteristic associated with the second transmission path;

detecting a fault condition associated with the communication bus in response to the measured electrical characteristic associated with the second transmission path; and

interrupting the flow of electrical signals along the first transmission path in response to the detected fault condition associated with the communication bus.

32. (Original) The method of claim 31, wherein detecting the fault condition associated with the communication bus includes detecting at least one of an open circuit, an electrical discontinuity, a cut in the communication bus, a severed communication bus, and a disconnected end of the communication bus.

33. (Original) The method of claim 31, wherein communicating electrical signals along the first transmission path includes communicating electrical signals in a first direction along a first pair of transmission wires and communicating electrical signals in a second direction along a second pair of transmission wires, and wherein communicating electrical signals along the second transmission path includes communicating electrical signals in the first direction along a third pair of transmission wires and communicating electrical signals in the second direction along a fourth pair of transmission wires.

34. (Original) The method of claim 31, wherein communicating electrical signals along the first transmission path includes communicating electrical signals in a first direction along a first transmission wire and communicating electrical signals in a second direction along a second transmission wire, and wherein communicating electrical signals along the second transmission path includes communicating electrical signals in the first direction along a third transmission wire and communicating electrical signals in the second direction along a fourth transmission wire.

35. (Original) The method of claim 31, wherein measuring the electrical characteristic associated with the second transmission path includes measuring current, voltage, or resistance.

36. (Original) The method of claim 31, further including comparing the measured electrical characteristic associated with the second transmission path to a normal operational value.

37. (Original) The method of claim 36, wherein interrupting the flow of electrical signals along the first transmission path includes opening switch contacts

coupled to the first transmission path in response to a change in the measured electrical characteristic associated with the second transmission path from the normal operational value.